
Process Evaluation Section

Consumer Electronic Plastics Recovery

Problem/Opportunity

A huge volume of electronic equipment (data processing, office equipment, telecommunication, TVs) is being discarded annually, and the volume is increasing. The number of computers alone that will be disposed of between 1985 and 2005 is estimated at more than 325 million. Electronic equipment is manufactured using a mix of materials such as metals, plastics, and glass. Recycling of electronic equipment is driven, primarily, by the value of the remaining useful components and the precious metals. Recycling and recovery of the plastics has proven to be very challenging because of the difficulty in recovering high-quality (high-purity) material. As many as ten different types of polymers are often used in electronic equipment. Because of the incompatibilities among the various types of thermoplastic polymers, they must be recovered at high purity to preserve their value. In 1995, more than 1.6 billion pounds of thermoplastics were used in electronic equipment manufacturing. Thermoplastics materials are typically the most valuable materials in the electronics waste stream (after precious metals). Currently available technologies for recovering and separating plastics from obsolete electronic equipment are not cost effective and as a result, the plastics end up in landfills.

Approach

The purpose of this project, sponsored by the U.S. Department of Energy's Office of Environmental Management and our industrial partners, (TORNRC and 5R Processors Ltd.) was to determine the

feasibility of using ANL's froth-flotation technique as a method for recovering a high-quality plastic product from electronic waste streams. Laboratory tests were conducted to determine the appropriate froth-flotation parameters needed to obtain a pure product. The wetting characteristics of plastic materials can be adjusted by selectively controlling the pH, surface tension, and specific gravity of a solution, which causes the co-mingled plastics to separate from one another.



Increasing volume of obsolete and other consumer electronics present a recycling challenge and opportunity.

Results

A process was developed to recover a highly pure product of acrylonitrile-butadiene-styrene (ABS) and polycarbonate (PC) from the electronic product waste stream. The recovery process was tested in ANL's 50-lb/hr froth-flotation test stand. The process was successful in recovering ABS-PC at a purity of greater than 97% and a yield of 70%. Over 1,000 pounds of feed material

were processed to prove the continued success of the developed process.



Clean ABS flake is recovered from scrapped electronic appliances using a froth-flotation technique developed by Argonne National Laboratory.

Future Plans

Based on the experimental data generated from the test stand experiments, the initial design for a pilot plant that will process over 1,000 pounds of feed material per hour is presently underway. Upon completion of the design work, a pilot plant will be built and operated at an industrial site to confirm the technical and economic feasibility of recovering thermoplastics from an electronic waste stream.